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TRANSLATION

Approved For Release 2000/08/07 : CIA-RDP96-00787R000500090005-5

Continuing material from the first Congress of Psychotronic Research,  
Prague, 1973.

THE EFFECT OF SURFACE AND SPACE CHARGES ON THE LUMINESCENCE PATTERN THAT ACCOMPANIES  
PHOTOGRAPHING BY MEANS OF UNIPOLAR PULSES

by

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The process of obtaining images of various objects by means of high-frequency currents is based on the phenomenon of cold electron emission (2). "High-frequency" images register the distribution of an electric rather than a light field on the surface of an object (and in the case of a dielectric down to a certain depth also). Therefore, these images are unusual and are not similar to optical images: changes in their structure during the photographing of living organisms are evidence of a change in the configuration of the electric field on the skin. Such a change in man is evidently associated (other photographing conditions being equal) with his psychophysiological inward state.

It is well known that high-frequency discharge cameras are variously constructed capacitors any of whose plates may be the photographed object proper while the other may be a metallic electrode that is screened by a dielectric (photographic film). During the photographing process, cold emission takes place alternately from each of the electrodes (it should be noted that it is precisely for this reason that the image of the metallic electrode is superimposed on the image of the object).

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It was of interest to use a monopolar-postgenerator to separate the resultant pattern of the discharge luminescence into two patterns: One from the action of the positive voltage on the object, and the second from the action of the negative voltage.

As investigations have demonstrated, the luminescence patterns obtained as a result of photographing by means of pulses having different polarities have a different appearance. Depending on the photographic conditions, the form of the contour streamers may vary substantially and may sometimes take on the form of curved lines. It has been clarified that the decisive factor determining the shape of the contour streamers is the accumulation of surface charges on the photolayers. The luminescence changed as a result of a slight wetting of the photolayer. The length of the contour streamers increased significantly, and the curvature of the streamers gradually vanished. For a very wet layer, the length of the streamers decreased significantly, their luminescence energy dropped, as the image quality likewise became significantly degraded. This phenomenon may be explained by the fact that for a dry photolayer the accumulation of electric charge on the dielectric substrate of the photolayer takes place; this leads to interaction of the stored charge with the contour streamers and is manifested in their twisting. For an increase in the wetness of the photolayer the electrical charges are distributed uniformly over the the photolayer, and the contour streamers are shaped in the form of straight lines whose length depends on the degree of wetness of the photolayer. In the case of the discharge between objects through the air, the contour streamers follow along the lines of force of the field, and the effect of charge storage is not observed. When photographing is performed by means of a high-frequency pulse generator that

produces bipolar attenuating oscillations, the effect of charge accumulation on

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the photolayer is significantly lower and causes defocusing of the ends of the contour streamers. However, the wetting of the photolayer changes the luminescence pattern in this case also.

The effect of the space charge of the discharge gap on the structure of the image of the object was investigated by means of an additional source of direct voltage which was connected in series-opposition or series aiding with the voltage of the monopolar-pulse generator. Evidently, the change in the discharge pattern which was detected when the additional voltage source was cut in takes place as a consequence of the change in the electric field intensity in the discharge camera which results in a change in the cold-emission electron current. The presence of the direct voltage likewise changes the energy of impact ionization, thereby changing the conditions under which the space charge is formed in the discharge gap; this has an effect on the length of the discharge streamers, the luminescence energy of the active zones, and the definition and focusing of the over-all luminescence pattern.

As a result of the investigation that was performed, the effect of the accumulation of surface charges on the dielectric (photographic film) was clarified, as well as the effect of the space charge and the discharge gap on the structure of the image obtained by means of a unipolar-pulse generator. Therefore, in order to exclude artifacts in investigating living organisms by means of high-frequency electrical discharges and revealing the various effects that accompany vital activity, rigorously identical physical experimental conditions and consideration of the influence of the accumulation of surface and space charges are required.

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